CLAIMS

What is claimed is:

1. A particle reduction apparatus comprising:

a radiation absorption zone for receiving a gaseous flow carrying particulate matter;

a transparent shield surrounding at least a portion of the radiation absorption zone;

a radiation source for generating radiation and for directing the radiation into the radiation absorption zone to promote reduction of the particulate matter; and

an insulation layer at least partially surrounding the radiation source .

2. The apparatus of claim 1, further comprising:

a vacuum zone positioned between the radiation source and an impervious layer, wherein the impervious layer is annular to the insulation layer; and

a casing layer at least partially covering the insulation layer .

3. The apparatus of claim 1, wherein the insulation layer is reflective of radiation from the radiation source to direct radiation towards the radiation absorption zone.

4. The apparatus of claim 1, wherein the shield comprises of quartz.

5. The apparatus of claim 1, wherein the radiation source comprises of a thermally resistive element suitable for producing radiation.

6. The apparatus of claim 1, further comprising a seal disposed at the ends of the apparatus configured to prevent leakage of the gaseous flow.

7. The apparatus of claim 1, further comprising a power source coupled to the radiation source for providing power to the radiation source.

8. The apparatus of claim 7, further comprising a control module coupled with the radiation source and the power source, wherein the control module is operationally positioned between the radiation source and the power source.

9. The apparatus of claim 8, further comprising at least one sensor coupled to the control module for detecting at least one operational parameter of a system in which the apparatus is placed, for regulation of operation of the radiation source.

10. The apparatus of claim 9, wherein the at least one sensor detects the at least one parameter of the gaseous flow downstream of the radiation absorption zone, and wherein the control module is coupled to the at least one sensor and to the radiation source for regulating power to the radiation source based upon the at least one parameter.

11. The apparatus of claim 9, wherein the at least one sensor detects the at least one parameter of the gaseous flow upstream of the radiation absorption zone, and wherein the control module is coupled to the at least one sensor and to the radiation source for regulating power to the radiation source based upon the at least one parameter.

12. The apparatus of claim 9, wherein a first sensor detects the at least one parameter of the gaseous flow downstream of the radiation absorption zone and a second sensor detects the at least one parameter of the gaseous flow upstream of the radiation absorption zone, and wherein the control module is coupled to the sensors and to the radiation source for regulating power to the radiation source based upon the at least one parameter.

13. The apparatus of claim 8, further comprising a reagent inlet upstream of the radiation absorption zone.

14. The apparatus of claim 13, further comprising a valve coupled to the reagent inlet.

15. The apparatus of claim 14, wherein the valve is coupled to the control module and wherein operation of the valve is regulated by the control module.

16. A particulate matter reduction system comprising:

a source of a gaseous flow carrying particulate matter;

a particle reduction apparatus comprising

a radiation absorption zone for receiving a gaseous flow carrying particulate matter,

a transparent shield surrounding at least a portion of the radiation absorption zone,

a radiation source for generating radiation and for directing the radiation into the radiation absorption zone to promote reduction of the particulate matter,

an insulation layer at least partially surrounding the radiation source; and

a control module coupled to the particle reduction apparatus.

17. The system of claim 16, further comprising:

a channel for directing the gaseous flow from the source to the particle elimination apparatus; and

a seal disposed between the apparatus and the channel for preventing leakage of the gaseous flow.

18. The system of claim 16, further comprising a power source to provide power to the radiation source.

19. The system of claim 18, wherein the control module is positioned operationally between the radiation source and the power source.

20. The system of claim 19, further comprising at least one sensor coupled to the control module for detecting at least one operational parameter of the system for regulation of the radiation source.

21. The system of claim 20, wherein the at least one sensor detects the at least one parameter of the gaseous flow downstream of the radiation absorption zone, and wherein the control module is coupled to the at least one sensor and to the radiation source for regulating power to the radiation source based upon the at least one parameter.

22. The system of claim 20, wherein the at least one sensor detects the at least one parameter of the gaseous flow upstream of the radiation absorption zone, and wherein the control module is coupled to the at least one sensor and to the radiation source for regulating power to the radiation source based upon the at least one parameter.

23. The system of claim 20, wherein a first sensor detects the at least one parameter of the gaseous flow downstream of the radiation absorption zone and a second sensor detects the at least one parameter of the gaseous flow upstream of the radiation absorption zone, and wherein the control module is coupled to the sensors and to the radiation source for regulating power to the radiation source based upon the at least one parameter.

24. The system of claim 19, further comprising a reagent inlet upstream of the radiation absorption zone.

25. The system of claim 24, further comprising a valve coupled to the reagent inlet.

26. The system of claim 25, further comprising a reagent source coupled to the reagent inlet, wherein the reagent source supplies at least some quantity of a reagent to the inlet and wherein supply of reagent is controlled by the valve.

27. The system of claim 26, wherein the valve is coupled to the control module and wherein operation of the valve is regulated by the control module.

28. The system of claim 16, wherein the source of gaseous flow is a carbonaceous material combustion module exhaust.

29. The system of claim 28, wherein the source of gaseous flow is an internal combustion engine.

30. The system of claim 16, further comprising a catalytic converter coupled to the particle elimination apparatus, wherein the catalytic converter is positioned downstream of the particle elimination apparatus.

31. The system of claim 16, wherein the particle reduction apparatus further comprises:

a vacuum zone positioned between the radiation source and an impervious layer, wherein the impervious layer is annular to the insulation layer; and

a casing layer at least partially covering the insulation layer.

32. A method for reducing particulate matter in a gaseous flow, comprising:

introducing the gaseous flow carrying the particulate matter into a radiation absorption zone; and

exposing the particulate matter to radiation in the radiation absorption zone, to at least partially reduce the particulate matter, as the gaseous flow traverses the radiation absorption zone.

33. The method of claim 32, further comprising controlling a radiation source to regulate the radiation in the radiation absorption zone.

34. The method of claim 33, further comprising detecting an operational parameter for controlling the radiation source.

35. The method of claim 32, further comprising introducing a reagent into the radiation absorption zone.

36. The method of claim 35, further comprising controlling the rate of introduction of the reagent.

37. The method of claim 32, wherein exposing the particulate matter to radiation occurs in discrete intervals of time.

38. The method of claim 32, further comprising increasing residence time of the particulate matter in the radiation absorption zone.

39. The method of claim 38, wherein increasing the residence time is achieved by increasing the length of the radiation absorption zone.

40. A method of reducing particulate matter in a gaseous flow comprising:

introducing the gaseous flow having particulate matter in a radiation absorption zone;

exposing the particulate matter to radiation in the radiation absorption zone;

sensing an amount of the particulate matter present in the gaseous flow; and

controlling the radiation in the radiation absorption zone based on the amount of the particulate matter present in the gaseous flow.

41. A system for reducing particulate matter in a gaseous flow comprising:

means for introducing the gaseous flow carrying the particulate matter into a radiation absorption zone;

means for providing radiation into the radiation absorption zone, to the particulate matter, to at least partially reduce the particulate matter, as the gaseous flow traverses the radiation absorption zone;

means for controlling the radiation provided into the radiation absorption zone; and

means for exiting the gaseous flow from the radiation absorption zone.

42. A system for reducing particulate matter in a gaseous flow comprising:

means for introducing the gaseous flow carrying the particulate matter into a radiation absorption zone;

means for providing radiation into the radiation absorption zone, to the particulate matter, to at least partially reduce the particulate matter, as the gaseous flow traverses the radiation absorption zone;

means for sensing an amount of the particulate matter in the gaseous flow; and

means for controlling the means for providing radiation based on the amount of particulate matter present in the gaseous flow.